Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

LIBRARY
RECEIVED
AUG 1924
U.S. Department of Agriculture

UNITED STATES
DEPARTMENT OF AGRICULTURE
DEPARTMENT CIRCULAR 330

Washington, D. C. July, 1924

WORK OF THE HUNTLEY RECLAMATION PROJECT EXPERIMENT FARM IN 1922[1]

DAN HANSEN

Associate Agronomist, Office of Western Irrigation Agriculture, Bureau of Plant Industry

CONTENTS

	Page		Page
Introduction	1	Investigations in dry-land agriculture	12
Conditions on the project	2	Experiments with dairy cattle	21
Work of the experiment farm	7	Feeding experiments with hogs	27
Experiments with irrigated crops	10	Crop-utilization experiments	29

INTRODUCTION

In this report are presented some of the more important results of experiments at the Huntley Experiment Farm in 1922, as well as a brief statement of the agricultural development and conditions on the Huntley Reclamation Project. The work of this farm includes experiments in the production of crops of local importance both on irrigated and dry lands and experiments in crop utilization through the use of livestock.

The experiments with crops were continued as in previous years, with some slight modifications and additions. The investigational work included a rather extensive series of rotation and tillage experiments, on both irrigated and dry land; experiments with pasture grasses; varietal tests of grain and forage crops; tests of silage crops; and tests of fruit trees, small fruits, and vegetables.

The work with livestock consisted of experiments in feeding, management, and breeding dairy cattle and hogs. The experiments with dairy cattle included pasture carrying-capacity tests, methods of feeding, and the production of cows on advanced registry tests. The work with hogs included alfalfa pasturing tests with various supplemental feeds, pasturing tests of dry-land crops, and dry-lot feeding.

[1] The Huntley Experiment Farm is located on the Huntley Reclamation Project in the Yellowstone Valley of Montana. The farm occupies about 300 acres of public land, the greater part of which is irrigated. It is maintained cooperatively by the Office of Western Irrigation Agriculture of the United States Department of Agriculture and the Montana Agricultural Experiment Station. Other offices and divisions of the United States Department of Agriculture in both the Bureau of Plant Industry and the Bureau of Animal Industry cooperate in the investigational work.

9956—25†——1

CONDITIONS ON THE PROJECT

CLIMATIC CONDITIONS

Weather conditions during the crop season of 1922 were in general favorable. Although the planting season was delayed by stormy weather, the soil was in excellent condition and well supplied with moisture for starting crops, and irrigation was not required until crops were well established.

The total precipitation in 1922 was 19.95 inches, whereas the average for the 12 years including and preceding 1922 was 14.29 inches. Of the total precipitation 13.47 inches fell during the five months from April to August, inclusive, and the rainfall during each of these months was above normal. The irrigation requirements of most crops were less than usual, because of the favorable distribution of rain during the growing season.

The period free from frost extended from May 5 to September 28, a total of 145 days, and the average frost-free period for the 12 years since 1911 was 128 days. The season was especially favorable for the maturing and harvesting of late crops.

No severe storms occurred at any time, and the season was free from any damage by hail. The climatological observations for the 12-year period from 1911 to 1922 are given in Table 1.

TABLE 1.—*Summary of climatological observations made at the Huntley Experiment Farm for the 12-year period from 1911 to 1922, inclusive*

PRECIPITATION (INCHES)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Average for 12 years, 1911 to 1922	0.71	0.38	0.73	1.18	2.40	2.56	1.30	0.76	1.34	1.21	0.90	0.82	14.29
For 1922	1.75	.80	.30	3.55	2.65	4.68	1.75	.84	.34	.49	1.27	1.53	19.95

EVAPORATION (INCHES)

Average for 12 years, 1911 to 1922	------	------	------	3.393	4.721	6.232	7.515	7.501	4.382	------	------	------	33.744
For 1922	------	------	------	3.145	4.565	5.354	6.500	7.330	5.255	------	------	------	32.149

DAILY WIND VELOCITY (MILES PER HOUR)

Highest:													
1911 to 1922	22.2	14.1	27.8	17.8	17.5	10.2	27.5	7.3	10.5	29.4	25.0	26.6	------
For 1922	11.8	9.1	27.8	9.7	11.4	5.1	5.5	5.9	(1)	(1)	(1)	10.1	------
Lowest:													
1911 to 1922	.3	.6	.5	.9	.7	.4	.3	.3	.2	.8	.5	.1	------
For 1922	.4	.6	1.0	1.7	.7	.9	1.4	1.3	------	------	------	.3	------
Mean:													
1911 to 1922	5.5	4.6	4.6	5.4	5.1	3.8	3.4	3.3	3.8	4.0	4.3	4.8	------
For 1922	5.0	3.7	5.2	4.7	4.8	3.0	3.0	3.1	------	------	------	3.8	------

[1] Anemometer broken September 26.

TEMPERATURE (°F.)

Absolute maximum:													
1911 to 1922	65	70	74	87	99	107	103	103	95	91	75	63	------
For 1922	43	44	58	79	90	92	99	102	95	91	65	52	------
Absolute minimum:													
1911 to 1922	−39	−38	−37	4	22	32	38	34	24	−10	−28	−41	------
For 1922	−30	−33	1	4	31	38	40	46	34	19	−4	−32	------
Mean:													
1911 to 1922	19	22	32	45	53	64	71	69	57	45	33	21	------
For 1922	13	7	32	43	54	65	69	74	61	49	30	15	------

TABLE 1.—*Summary of climatological observations made at the Huntley Experiment Farm for the 12-year period from 1911 to 1922, inclusive*—Continued

KILLING FROSTS

Year	Last in spring		First in autumn		Frost-free period	Year	Last in spring		First in autumn		Frost-free period
	Date	Minimum temperature	Date	Minimum temperature			Date	Minimum temperature	Date	Minimum temperature	
		°F.		°F.	Days			°F.		°F.	Days
1911	May 26	32	Sept. 18	28	114	1919	May 7	29	Sept. 27	32	142
1912	May 13	28	Sept. 16	31	125	1920	June 3	32	Sept. 24	32	112
1913	May 5	31	Sept. 19	29	136	1921	May 14	32	Sept. 9	32	117
1914	May 12	32	Oct. 6	31	146	1922	May 5	31	Sept. 28	29	145
1915	May 21	32	Sept. 19	32	120						
1916	May 16	30	Sept. 13	31	119	Average	May 17	31	Sept. 23	31	128
1917	May 31	31	Sept. 28	32	119						
1918	May 21	32	Oct. 7	28	138						

CROP CONDITIONS

With the exception of damage resulting to certain crops by grasshopper invasion, conditions affecting crop production were favorable. The growing season was unusually long and free from any unfavorable weather conditions. The principal damage by grasshoppers was to the first and second crops of alfalfa and to grain crops, although this damage appeared to be less than during the previous year, owing probably to a more general application of control measures, in which the standard arsenic-bran mash was used and appeared to be effective where properly applied.

TABLE 2.—*Acreage, yields, and farm values of crops produced on the Huntley Reclamation Project in 1922*

Crop	Area (acres)	Unit of yield	Yields			Farm values		
			Total	Per acre		Per unit of yield	Total	Per acre
				Average	Maximum			
Alfalfa hay	6,167	Ton	14,102	2.28	4.75	$8.48	$119,620	$19.39
Alfalfa seed	32	Bushel	24	.75	2	7.00	168	5.25
Barley	223	do	6,571	29.46	70	.48	3,147	14.11
Beans	11	do	839	76.27	166	2.23	1,869	169.91
Beets, sugar	3,106	Ton	34,901	11.23	17.5	8.00	279,208	89.89
Clover hay	2	do	8	4	4	7.50	60	30.00
Clover seed	120	Bushel	982	8.20	27	3.92	3,850	32.08
Corn	425	do	9,164	21.56	50	.74	6,775	15.94
Corn fodder	64	Ton	142	2.22	8	5.51	782	12.22
Garden	207						20,959	101.25
Hay other than alfalfa	40	Ton	26	.65	2	7.23	188	4.70
Oats	1,434	Bushel	47,068	32.83	100	.57	26,900	18.76
Onions	4	do	625	156	240	1.80	1,127	281.75
Pasture, summer	1,670						11,442	6.80
Pasture, winter	11,181						18,594	1.66
Potatoes	149	Bushel	20,218	135	300	.49	9,992	67.05
Rye	4	do	128	32	32	.30	38	9.50
Wheat	5,793	do	115,416	19.92	30	.87	100,319	17.32
Corn silage	41	Ton	317	7.73	13.27	5.00	1,585	38.66
Miscellaneous	31						974	31.43
No crop value [1]	60							
Total	19,523						607,597	
Average								31.12

[1] The area of 60 acres having "No crop value" was occupied by crops as follows: Alfalfa, 10 acres; alfalfa seed, 12 acres; barley, 6 acres; beans, 5 acres; clover seed, 8 acres; corn, 8 acres; potatoes, 5 acres; wheat, 6 acres. Total, 60 acres. The average entered as winter pasture is not included in the total cropped acreage.

CROPS ON THE PROJECT

As reported by the United States Reclamation Service the total cropped area of the Huntley project in 1922 was 19,523 acres. The principal crop acreages were alfalfa, wheat, sugar beets, oats, pasture, and corn, ranking in acreage in the order given. Table 2 gives the acreage, yield, and farm value of crops grown on the Huntley project in 1922, and Table 3 gives the same data for the 10-year period from 1913 to 1922.

Alfalfa was grown on 6,167 acres, or nearly one-third of the cropped area of the project. The average yield was reported to be 2.5 tons per acre, with a maximum yield of 4.75 tons. This yield was slightly less than the average for the 10-year period and is perhaps at least 1 ton per acre lower than the yields on the better lands on the project, because a part of the land covered by this report is in the lower end of the project where much of the soil is heavy and of comparatively low productivity.

The farm value of alfalfa was $8.48 per ton, which probably more nearly represents the price received for hay early in the feeding season because the price declined later to about $5 per ton, owing to an open winter and consequent low demand. The acre value of hay was $19.39. The larger part of the hay produced was required for local feeding, and only a small quantity was shipped out.

Wheat ranked as one of the important crops of the project in 1922 in point of acreage. This crop occupied 5,793 acres, or somewhat more than one-fourth of the total area in crops. The yield of 19.72 bushels per acre was slightly higher than the 10-year average, but the farm value of 87 cents per bushel was less than at any time during the past seven years.

The area cropped to sugar beets was about the same as in 1921, being 3,106 acres. The yield of 11.23 tons per acre was nearly 1 ton higher than in any year during the 10-year period and was 1.66 tons higher than the average during this period. Loss of stand through black-rot, which occurs mainly on the lighter soils, reduced the harvested acreage of this crop to some extent. Since this condition usually occurs after the beet plants are well started, reseeding is not always practicable. Where the loss is extensive the land is seeded to some late grain crop, such as oats.

The value of beets per ton is given at $8, although it is not definitely known that this will be the final price, since the crop was sold on a sliding-scale basis depending upon the final selling price of sugar manufactured from the beets. The initial price was $5.50 per ton, with later payments made as the sugar was marketed.

The area cropped to oats was slightly less than in preceding years, amounting in 1922 to 1,434 acres. The acreage of this crop has decreased steadily since 1913. Oats are grown mainly for feed for work stock and are not of great importance as a cash crop.

Corn has never been an important crop on the project, although there was an increase in acreage in 1922, with this crop grown on 530 acres. Although the average yield was only 23.2 bushels per acre, yields of 50 bushels per acre were reported. There appears to be an increasing interest in corn, and with the selection and improvement of varieties adapted to this region it would appear that the area could be increased to some extent with advantage. For silage, varieties maturing sufficiently early have been found to yield from 8 to 13 tons per acre.

TABLE 3.—*Summary of acreage, yields, and farm values of the principal crops grown on the Huntley Reclamation Project during the 10-year period from 1913 to 1922, inclusive*

Item and year	All crops [1]	Alfalfa hay	Barley	Sugar beets	Corn	Oats	Summer pasture	Winter pasture	Potatoes	Wheat
Acreage:										
1913	15,798	4,848	191	4,475	326	3,942			99	1,177
1914	17,068	6,038	363	4,274	497	3,226			120	1,663
1915	18,183	5,287	415	5,402	509	2,514	1,478		80	2,869
1916	18,581	5,422	298	5,264	174	2,628	1,393		54	2,624
1917	19,104	6,002	109	3,366	186	2,420	1,451		164	4,330
1918	19,265	6,766	75	1,963	203	2,006	1,091		73	6,306
1919	19,310	7,045	267	1,136	179	1,977	1,389	16,733	40	6,518
1920	20,021	7,468	324	2,330	392	1,764	2,074	15,550	78	5,098
1921	18,782	5,538	247	3,178	375	1,630	1,479	15,476	185	5,469
1922	19,523	6,167	223	3,106	[2] 530	1,434	1,670	11,181	149	5,793
Production:		*Tons*	*Bus.*	*Tons*	*Bus.*	*Bus.*			*Bus.*	*Bus.*
1913		16,725	2,535	45,511	5,418	113,766			11,889	21,410
1914		17,440	6,689	41,030	11,755	96,014			10,680	39,095
1915		15,010	8,196	53,911	9,258	75,319			9,360	56,863
1916		14,411	2,239	42,106	1,732	37,795			5,155	31,161
1917		14,062	1,304	28,553	3,497	70,470			21,272	83,450
1918		17,234	1,883	16,299	4,263	73,080			9,612	138,305
1919		18,713	5,354	12,015	5,046	58,707			4,781	103,149
1920		16,962	4,816	14,814	4,441	40,960			6,449	83,549
1921		9,564	5,906	31,924	7,307	35,191			18,500	93,684
1922		14,102	6,571	34,901	9,164	47,068			20,218	115,416
Average acre yield:										
1913		3.45	13.27	10.17	16.62	28.86			120.10	18.19
1914		2.90	18.40	9.60	23.75	29.80			89.00	23.50
1915		2.82	19.75	9.98	18.19	29.96			117.00	19.82
1916		2.66	7.50	8.00	9.97	14.38			95.02	11.87
1917		2.34	12.00	8.48	18.78	29.11			129.71	19.25
1918		2.55	25.11	8.30	21.20	36.43			132.12	21.93
1919		2.65	20.05	10.58	28.19	29.69			119.70	15.82
1920		2.27	14.82	6.36	11.33	23.22			82.68	16.38
1921		1.73	23.91	10.04	19.51	21.58			100.00	17.12
1922		2.28	29.46	11.23	21.56	32.83			135.75	19.92
FARM VALUE										
Per unit of yield:										
1913		$5.50	$0.48	$6.00	$1.05	$0.32			$0.45	$0.66
1914		5.00	.53	6.00	.62	.32			.62	.98
1915		5.76	.53	5.92	.80	.49			.72	.87
1916		8.95	.92	6.08	.86	.63			1.14	1.46
1917		14.70	1.20	7.27	1.46	.78			.77	1.88
1918		11.99	.98	10.00	1.25	.79			.69	1.94
1919		19.66	1.68	10.00	1.53	1.16			1.77	2.37
1920		7.90	.89	12.00	.81	.67			1.11	1.44
1921		7.97	.46	6.78	.63	.40			.81	1.01
1922		8.48	.48	8.00	.74	.57			.49	.87
Per acre:										
1913	$29.35	18.97	6.37	61.02	17.45	9.24			54.04	12.00
1914	26.63	14.45	9.75	57.60	14.65	9.54			55.18	23.03
1915	29.41	16.35	10.47	59.08	14.55	14.68	$3.76		84.24	17.24
1916	26.32	23.84	6.93	48.61	8.62	9.00	6.36		108.55	17.35
1917	36.16	34.46	14.42	61.66	27.39	22.69	6.36		99.65	36.22
1918	39.00	30.57	24.71	83.00	26.50	28.86	9.70		90.93	42.60
1919	49.14	52.22	33.69	105.77	43.11	34.40	11.94	$3.94	211.55	37.51
1920	27.11	17.94	13.23	76.29	9.18	15.55	8.74	1.82	91.77	23.54
1921	25.23	13.78	10.96	68.07	13.31	8.51	5.40	1.52	81.43	17.29
1922	31.12	19.39	14.11	89.89	15.94	18.76	6.85	1.66	67.05	17.32
Total:										
1913	463,697	91,987	1,216	273,066	5,688	36,405			5,350	14,130
1914	454,583	87,200	3,545	246,180	7,288	30,724			6,622	38,313
1915	535,363	86,458	4,344	319,153	7,406	36,906	5,557		6,739	49,471
1916	489,071	129,263	2,068	255,826	1,496	23,651	8,867		5,889	45,529
1917	690,760	206,838	1,568	207,562	5,101	54,915	9,237		16,301	156,838
1918	750,964	206,712	1,854	162,990	5,381	57,899	10,588		6,616	268,616
1919	948,968	367,898	8,995	120,150	7,720	68,000	16,580	65,834	8,462	244,464
1920	543,781	134,000	4,289	177,769	3,597	27,443	18,136	28,301	7,158	120,041
1921	473,860	76,234	2,707	216,445	4,991	13,873	7,981	23,483	15,065	94,521
1922	607,597	119,620	3,147	279,208	[2] 9,142	26,900	11,442	18,594	9,992	100,319

[1] The figures for total cropped acreage do not include the acreage of winter pasture, and in 1918 some of the acreage used for summer pasture was also used for other crops.

[2] Corn in 1922 itemized as follows: Main crop, 425 acres, $6,775; corn fodder, 64 acres, $782; corn silage, 41 acres, $1,585.

The use of summer pastures is increasing to some extent on the project, and 1,670 acres were used for this purpose in 1922. Part of this is in native grass and waste land, but much of it is pasture of cultivated mixed grasses. These mixed-grass pastures carry from one to two cows per acre during the grazing season of nearly five months, and the land used for this purpose is found to give comparatively favorable returns.

The average farm values of all crops in 1922 was $31.12 per acre, which was slightly higher than during the two years previous. This increase in value was due largely to the increase in yields of the principal crops.

CONDITIONS RELATING TO LIVESTOCK

A statement of the total number of all classes of livestock on the Huntley project farms at the beginning and end of the year 1922 is given in Table 4. Similar data for each year since 1914 are given in Table 5. These tables were compiled from information furnished by the United States Reclamation Service.

TABLE 4.—*Livestock on the Huntley Reclamation Project in 1922*

Item	Inventory, Jan. 1			Inventory, Dec. 31			Increased or decreased total value
	Number	Average value	Total value	Number	Average value	Total value	
Horses	1,865	$64.53	$120,340	1,875	$52.26	$97,957	−$22,383
Mules	58	82.45	4,782	61	53.97	3,292	−1,490
Cattle:							
Beef	1,765	26.00	45,906	1,395	25.66	35,792	−10,114
Dairy	1,542	49.04	67,913	1,951	40.62	79,260	11,347
Sheep	1,486	4.00	5,944	1,310	7.43	9,730	3,786
Hogs	1,365	8.00	10,920	1,622	10.29	16,687	5,767
Fowls	18,500	.56	10,360	23,036	.63	14,521	4,161
Bees, hives	442	6.12	2,705	210	8.00	1,680	−1,025
Total			268,870			258,919	−9,951

TABLE 5.—*Number and value of livestock kept on farms on the Huntley Reclamation Project during the period from 1914 to 1922, inclusive*

Livestock	1914	1915	1916	1917	1918	1919	1920	1921	1922
Number:									
Horses	2,008	1,961	1,961	2,145	2,120	2,297	2,041	1,865	1,875
Mules	53	53	58	80	51	46	34	58	61
Cattle:									
Beef	2,921	3,316	1,982	1,795	1,813	2,631	1,312	1,765	1,395
Dairy			1,753	1,949	1,920	2,040	1,804	1,542	1,951
Sheep	847	6,198	3,729	1,974	1,130	2,115	2,352	1,486	1,310
Hogs	4,612	4,866	2,791	2,363	2,391	3,097	1,885	1,365	1,622
Fowls	23,345	18,758	16,418	16,920	15,856	21,456	18,232	18,500	23,036
Bees, hives	249	288	282	296	424	458	180	442	210
Average value of each:									
Horses	$108.88	$117.37	$124.00	$131.73	$108.70	$110.00	$88.90	$64.53	$52.26
Mules	134.90	135.09	138.00	134.56	107.16	81.50	94.40	82.45	53.97
Cattle:									
Beef	47.45	47.05	42.00	47.51	51.03	47.70	43.00	26.00	25.66
Dairy			64.00	54.02	60.18	62.30	63.45	44.04	40.62
Sheep	3.22	4.71	5.80	8.13	13.41	8.40	6.27	4.00	7.43
Hogs	9.68	5.51	8.00	15.40	18.07	13.64	11.15	8.00	10.29
Fowls	.49	.50	.54	.61	.52	.66	.69	.56	.63
Bees, hives	3.07	5.09	3.33	3.17	3.78	5.35	7.30	6.12	8.00
Total value:									
Horses	218,640	230,175	243,095	282,570	230,435	252,670	181,445	120,340	97,957
Mules	7,150	7,160	8,004	10,765	5,465	3,749	3,210	4,782	3,292
Cattle—									
Beef	138,625	156,023	83,244	85,280	92,517	125,498	56,416	45,906	35,792
Dairy			112,192	105,290	115,545	127,092	114,464	67,913	79,260
Sheep	2,730	29,199	21,578	16,064	15,153	17,766	14,745	5,944	9,730
Hogs	44,536	26,822	22,328	36,365	43,205	42,242	21,018	10,920	16,687
Fowls	11,356	9,379	8,900	10,343	8,245	14,162	12,680	10,360	14,521
Bees, hives	758	1,467	939	940	1,603	2,450	1,314	2,705	1,680

Although none of the livestock industries is extensive, dairying is of the most importance. The livestock inventory indicated that at the end of the year there was a total of 1,951 dairy cattle on project farms, which was an increase of more than 25 per cent over the number reported during the previous year. Since a large number of project farms are operated by tenants who seldom keep livestock, dairying will probably not be followed so generally as it might be with advantage, although among resident farm owners there appears to be an increasing interest in this industry. Of importance to local dairying is the lending of purebred bulls from the experiment-farm herd of Holstein cattle. The first of these bulls have been in use for only four years, and in most cases improvement in type and production are apparent in the heifers sired. At present 18 of these bulls are in use on the project and in adjacent territory. Several of the more successful dairy farmers are making use of irrigated mixed-grass pastures, as recommended by the experiment farm, and a few silos have been constructed. For silage, early-maturing varieties of corn that yield from 8 to 13 tons per acre are used.

Although the number of hogs increased somewhat during the year, only 1,622 were reported in the inventory of December 31. A substantial increase occurred in poultry, 23,000 being reported at the end of the year. These are kept in farm flocks of 100 to 500 hens.

A few small farm flocks of sheep are maintained, but the number given in this report was made up largely of sheep brought in for winter feeding. It would appear that the number of sheep both for farm flocks and for winter feeding might be increased to advantage, because sheep will utilize large quantities of feed that is otherwise wasted.

WORK OF THE EXPERIMENT FARM

CROP-ROTATION EXPERIMENTS

The season of 1922 completed 11 years of experimental work with irrigated crop rotations at the Huntley Experiment Farm. The purpose of this line of investigation is to determine which combination and arrangement of crops is conducive to the largest yield and to ascertain the influence of manuring and other cultural treatments on production.

Since 1912, 70 quarter-acre plats in field K have been devoted to these experiments, and in 1916 the work was extended to include 27 quarter-acre plats in field L–IV. (Fig. 1.)

Seven crops of local importance are used in the irrigated crop-rotation experiments. These crops—alfalfa, sugar beets, potatoes, oats, wheat, corn, and flax—are grown in eleven 2-year, five 3-year, four 4-year, and six 6-year rotations. In addition, there are 14 plats on which the same crop is grown continuously. The average, maximum, and minimum yields of these crops obtained in 1922, together with the average yields for the years 1913 to 1921, inclusive, are given in Table 6.

The results of these experiments indicate that the maximum yields of small grains and row crops are usually obtained in the longer rotations, which include alfalfa or the application of barnyard manure, whereas the minimum yields are generally found in the

shorter rotations and in the plats which have produced the same crop continuously.

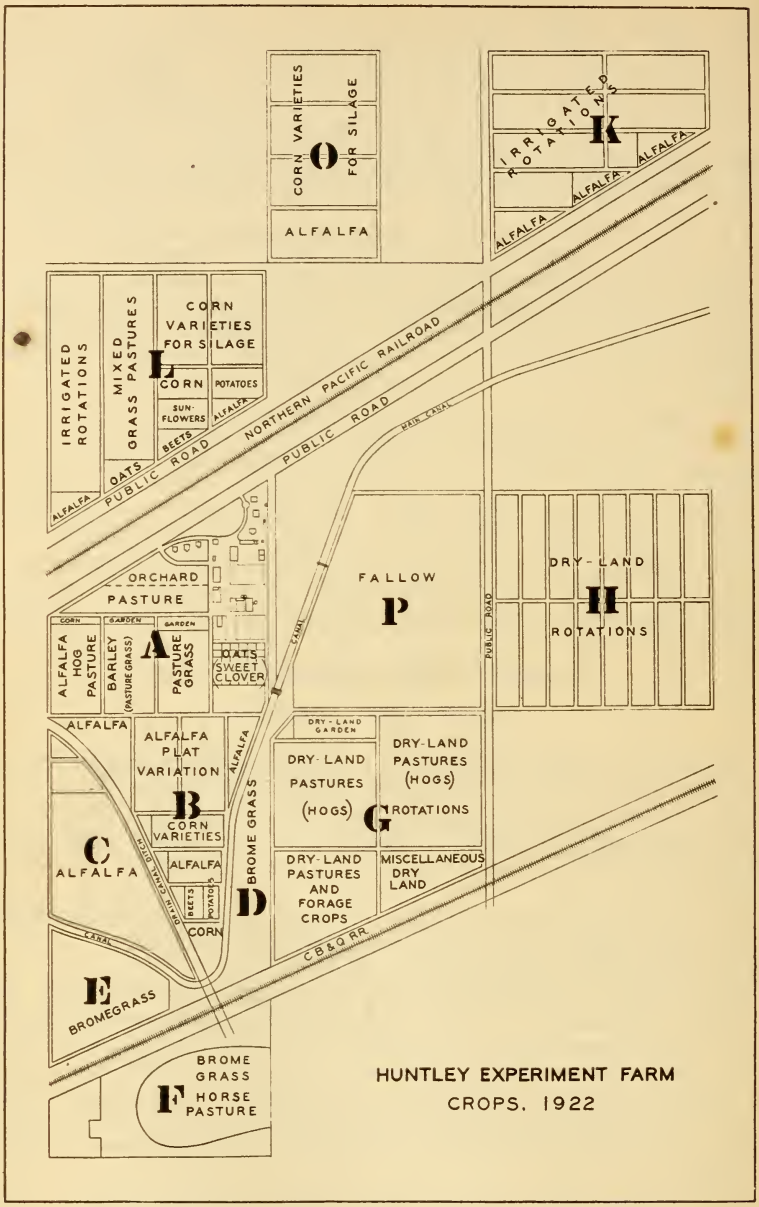

FIG. 1.—Diagram showing the arrangement of the fields and the location of the experiments at the Huntley Experiment Farm in 1922

Table 7 gives the yields of oats, potatoes, and sugar beets in 1922 in the various rotations after the crops mentioned.

TABLE 6.—*Yields of all crops in the irrigated rotations on the Huntley Experiment Farm in 1922, compared with the average yields of the same crops in the 9-year period from 1913 to 1921, inclusive*

[Yields are stated in tons for alfalfa and sugar beets and in bushels for the other crops]

Crops and variety	Number of plats	Yields per acre											
		1922			1921	1920	1919	1918	1917	1916	1915	1914	1913
		Maximum	Minimum	Average									
Alfalfa (Grimm):													
Spring seeded	5	2.96	2.08	2.40	1.39	1.87	1.25	2.22	2.03	2.07	2.34	2.22	2.20
Fall seeded	4	4.17	2.52	3.32	1.89	3.38	2.63	3.17	3.42				
Second year	9	6.61	5.22	5.96	3.53	4.59	6.09	5.34	5.71	5.26	7.14	5.40	5.85
Third year [1]	5	6.70	6.12	6.44	2.98	5.68	4.24	6.13	5.38	6.26	7.00	5.26	5.35
Continuously cropped	5	6.35	4.51	5.10	2.82	4.65	5.77	5.45	4.65	4.98	4.72	4.62	4.51
Sugar beets (Kleinwanzlebener)	19	18.54	7.84	13.40	10.78	7.63	10.15	12.23	9.82	11.17	9.58	11.16	13.06
Potatoes (Bliss Triumph)	17	283.3	71.3	191.3	231.3	136.4	249.3	367.6	218.2	240.3	301.8	167.8	212.7
Oats (Swedish Select)	21	105.0	56.2	88.5	66.0	63.6	52.7	90.7	75.0	78.2	79.3	89.8	84.2
Wheat (Pringle Champlain)	5	30.6	23.3	27.0	20.9	26.3	27.3	23.9	26.5	26.5	32.3	32.7	27.2
Corn [2] (Northwestern Dent)	8	82.0	30.9	55.8	49.2	47.9	42.7	45.9	32.6	36.3	36.9	42.9	42.0
Flax (Minnesota No. 25)	2	24.3	10.0	17.15	8.1	12.0	8.5	20.2	18.9	17.7	21.3	18.6	21.7

[1] Two of the third-year plats are hogged off; the average given is for three plats.
[2] Three of the corn plats are hogged off and the yields estimated.

TABLE 7.—*Yields per acre of oats, potatoes, and sugar beets following stated crops in the irrigated rotations on the Huntley Experiment Farm in 1922*

[The application of manure wherever noted was made after the preceding crop mentioned was harvested]

Oats			Potatoes			Sugar beets		
Preceding crop	Rotation No.	Yield	Preceding crop	Rotation No.	Yield	Preceding crop	Rotation No.	Yield
		Bush.			*Bush.*			*Tons*
Alfalfa	42	105.0	Oats (manure)	35	283.3	Oats (manure)	61	18.54
Beets	23	105.0	Alfalfa	64	282.0	Flax	67	17.69
Do	46	101.3	Do	61	279.3	Potatoes	21	16.35
Potatoes	44	100.0	Oats (manure)	25	275.3	Oats (manure)	23	15.64
Corn (hogged)	69	98.9	Alfalfa	40	272.3	Do	31	15.27
Potatoes	61	98.7	Oats	34	236.7	Oats	60	15.05
Do	25	97.5	Alfalfa	60	212.0	Potatoes	64	14.99
Do	60	96.2	Do	44	204.7	Do	35	14.97
Beets	64	93.8	Oats	24	169.7	Oats	32	13.80
Do	34	92.5	Potatoes	4a	166.0	Alfalfa	46	13.66
Do	35	92.5	Beets	30	159.0	Potatoes	20	13.04
Potatoes	31	92.5	Potatoes	4	138.0	Do	40	12.47
Beets	22	88.7	Corn	26	136.0	Do	34	12.16
Potatoes	30	81.8	Beets	31	128.7	Oats	30	11.35
Do	27	80.0	Beets (manure)	21	126.0	Do	22	11.19
Oats	1a	78.8	Beets	20	112.7	Beets	2	11.05
Potatoes	24	78.7	Oats (rye) [1]	27	71.3	Oats	42	10.18
Corn	32	75.0				Wheat	18	9.44
Do	16	73.7				Beets	2a	7.84
Wheat	28	72.5						
Oats	1	56.2						
Average		88.5	Average		191.3	Average		13.40

[1] In this rotation rye is seeded in the oat stubble in the fall and plowed under the following spring.

The maximum yield of oats was obtained in two rotations, one where oats followed alfalfa and the other where oats followed beets. In each rotation the oats yielded at the rate of 105 bushels per acre.

The next highest yield of oats was also obtained when oats followed beets. The average yield of the six plats of oats following beets was 95.6 bushels per acre. Oats following potatoes gave the third highest yield, with an average of 90.7 bushels per acre from eight plats. The minimum yield per acre of oats was obtained from oats following oats, two plats giving an average of 67.5 bushels per acre.

Potatoes gave the highest yield following oats (manure), two plats yielding 279.3 bushels per acre. Five plats of potatoes having alfalfa as a preceding crop gave an average of 250.1 bushels per acre, which was the second highest yield obtained. Potatoes after oats ranked third, with two plats yielding 203.2 bushels of potatoes per acre. The minimum yield of potatoes was obtained from rotation 27, oats (rye) followed by potatoes. In this rotation rye is seeded in the oat stubble in the fall and plowed under the following spring.

Sugar beets produced the highest yield in a 6-year rotation of three years of alfalfa (third year hogged off), corn (hogged off), flax, and sugar beets. The sugar beets followed the flax in this rotation and produced 17.69 tons per acre. This high yield of sugar beets was no doubt due to the effect of three years of alfalfa and the manure resulting from hogging off the third-year alfalfa and the corn. Oats (manure) as a preceding crop for sugar beets ranked second, three plats of sugar beets grown in this way yielding 16.48 tons per acre. Beets following potatoes and alfalfa ranked third and fourth, with yields of 14 and 13.66 tons per acre, respectively. The lowest yields of sugar beets were obtained from two plats on which beets have been grown each year and from the rotation of beets with wheat, the two plats continuously cropped to beets giving an average yield of 9.44 tons per acre.

EXPERIMENTS WITH IRRIGATED CROPS

CORN

Although corn has not been an important crop on the project, it appears from results obtained at the experiment farm that the acreage might be increased with advantage and that profitable yields of both silage corn and ear corn can be obtained through the selection of suitable early-maturing varieties.

In 1922 a test of four varieties of corn for silage was conducted on 24 quarter-acre plats in fields L–I and L–II. These varieties were Northwestern Dent, Paynes White Dent, Calico, and Mitchell White Dent.

A similar test was conducted in the same fields in 1921, in which only the first three varieties were used. In each year all the varieties were sufficiently matured by September 15 to make silage of good quality. The varieties Northwestern Dent and Paynes White Dent were grown from seed produced locally, while Calico and Mitchell White Dent were grown from seed produced in western Nebraska. The yields obtained in this test are shown in Table 8.

In 1921 the yields shown in each case were the average of eight plats, while in 1922 the yields were the average of six plats.

In connection with this experiment in 1922 a test of the value of applying barnyard manure to corn was made. Field L–I was manured at the rate of 12 spreader loads per acre, while field L–II was not manured. Previous to this time both of these fields had

received uniform treatment as regards crops and cultivation, because they were broken up from native sod in 1914 and neither of the fields had been manured. In each field three quarter-acre plats were cropped to each of the four varieties of corn.

TABLE 8.—*Yields of silage corn in variety tests on the Huntley Experiment Farm in 1921 and 1922*

Variety	Yields per acre (tons)		
	1921	1922	Average
Mitchell White Dent		11.34	
Calico	11.55	11.82	11.68
Paynes White Dent	9.70	11.48	10.59
Northwestern Dent	7.90	9.24	8.57

The results shown in Table 9 indicate that there was a definite increase in the yield of each variety due to the effect of the manuring. The average increase was about 2.8 tons per acre, which is equivalent to 30 per cent.

TABLE 9.—*Yields of silage corn in a manuring test on the Huntley Experiment Farm in 1922*

Variety	Yields per acre (tons)		
	Manured	Unmanured	Increase due to manure
Calico	13.14	10.50	2.64
Mitchell White Dent	12.57	10.12	2.45
Paynes White Dent	13.09	9.87	3.22
Northwestern Dent	10.71	7.76	2.95

The Northwestern Dent and Paynes White Dent varieties were grown from silage in fields O–II and O–III. The average yield from 11 quarter-acre plats of Paynes White Dent was at the rate of 10.82 tons per acre, while the average of 5 plats of Northwestern Dent was at the rate of 9.46 tons per acre.

RATE OF STAND FOR SILAGE CORN

In 1922 an experiment was conducted in which two rates of spacing corn for silage were used. Paynes White Dent corn was used in this experiment, and there were two quarter-acre plats at each spacing rate. The rows in each case were 40 inches apart; in one plat the distance between the plants in the row averaged 9.3 inches and in the other 16.2 inches. The average yield of the two plats with closer spacing was at the rate of 15 tons per acre, and the yield of the plats having the wider spacing was at the rate of 12.68 tons per acre, a difference of 2.32 tons in favor of the closer planting. The yields of grain were probably not much different in either case and were estimated to be about 50 bushels per acre. Therefore, the difference in yield of the silage corn was probably due largely to the extra quantity of stover produced on the plat in the closer planting.

CORN FOR GRAIN PRODUCTION

Two varieties of corn, Paynes White Dent and Northwestern Dent, were grown in fields O–II and O–III. The acre yields of Northwestern Dent on 12 quarter-acre plats were at the rate of 48.3 bushels of grain and 3.52 tons of stover, and 5 quarter-acre plats of Paynes White Dent yielded at the rate of 54.5 bushels of grain and 3.7 tons of stover per acre. This corn was planted on May 24, and both varieties were mature by September 15.

SUGAR-BEET FERTILIZER TEST

A preliminary test of fertilizers for sugar beets was conducted in 1922. The fertilizers used were sodium nitrate and acid phosphate, and the rate of application of each was 600 pounds per acre. The fertilizer was applied immediately before seeding the beets. The average yield of beets on two plats treated with sodium nitrate was at the rate of 12.65 tons per acre. The average yield of two plats treated with acid phosphate was at the rate of 13.68 tons per acre, while the average yield of five check plats not treated was 13.40 tons per acre, so that the differences in yield were not significant. There were no apparent differences in the appearance and growth of the crop.

INVESTIGATIONS IN DRY-LAND AGRICULTURE[2]

Since 1912, experiments dealing with various phases of dry farming have been conducted at the Huntley Experiment Farm by the Office of Dry-Land Agriculture Investigations. These investigations include an extensive series of crop rotations in which winter wheat, spring wheat, oats, barley, flax, corn, peas, rye, sweet clover, alfalfa, and bromegrass are grown in various combinations and by several cultural systems, such as spring plowing, fall plowing, summer fallowing, and "stubbling in." The storage of soil moisture and its use by crops under different methods of tillage are also being studied. A series of variety and cultural tests with potatoes, grains, beans, garden vegetables, forage, and other miscellaneous crops has been conducted to a small extent.

Pasturing experiments in which winter rye, peas, barley, corn, alfalfa, and bromegrass have been harvested by hogs have been in progress since 1915. Plats grown to the same crops are harvested by machinery, and the yields obtained by the two methods are compared. In 1922 the returns made by the hogs on pasture were compared with the returns made by similar pigs fed in a dry lot without pasture.

CONDITIONS INFLUENCING RESULTS

The growing season of 1922 was very favorable for most dry-land crops. Subnormal precipitation during the latter half of the preceding summer resulted in the accumulation of only a small moisture reserve in fallowed ground, while cropped land was exceedingly dry. Winter grains were of necessity planted in a dry seed bed, and for the most part the seed did not germinate until the following spring.

---

[2] This report was prepared by Arthur Seamans, who had charge of the dry-land work of the station, being detailed by the Office of Dry-Land Agriculture Investigations of the Bureau of Plant Industry.

Abundant rainfall during April and May provided sufficient moisture in the soil to give all crops a good start. The precipitation during June and July was not only above the average for these months but its favorable distribution contributed to relatively high yields of well-filled grain. With few exceptions all crops matured without serious damage from drought.

CROP ROTATIONS AND CULTURAL METHODS

Winter wheat.—Because of the dry condition of the soil in the fall Kharkof winter wheat sown on September 16 did not come up until April 24. The stands obtained were thinner than were desirable, and as a result weeds started in most of the plats before the wheat had made sufficient growth to control them. Conditions during the season were favorable for a heavy growth of straw, and the crop on some of the plats was badly lodged at harvest time. However, the winter-wheat yields of every cultural method employed in the experiment were above the averages of past seasons.

Table 10 presents the average yields of winter wheat obtained with each method of growing the crop in 1922 and also the average of each method during the previous years of the experiment.

TABLE 10.—*Acre yields of winter wheat from different methods of production on the Huntley Experiment Farm in 1922 compared with the yields from these methods during the period from 1913 to 1921, inclusive*

Seed-bed preparation	Preceding crop	Number of plats averaged each year	Average yield (bushels)	
			1913 to 1921	1922
Fall plowed	Winter wheat	[1] 4	13.8	22.7
Subsoiled	do	1	12.t	22.2
Listed	do	1	12.9	24.0
Disked grain stubble	do	[2] 5	10.0	24.5
Disked corn stubble	Corn	4	19.7	30.0
Fallow	Fallow	[3] 10	28.8	30.6
Green manured with rye	Winter rye	2	20.7	26.5
Green manured with peas	Peas	2	25.6	26.4
Average of average yields for each year		29	21.4	27.3

[1] Two plats previous to 1917.
[2] Begun in 1917.
[3] Three plats in 1913 and 1914, 9 plats in 1915 and 1916, 10 plats since 1916.

Spring wheat.—Kubanka wheat used in these experiments returned comparatively high yields during the year. Inasmuch as the crop was produced almost entirely on the seasonal precipitation, few significant differences in yields between the various methods of seed-bed preparation were obtained. For the most part the growth of straw was very heavy, and about one-third of the plats were partly or entirely lodged at harvest time. Table 11 shows the average yields from the various methods of growing spring wheat for 1922 and the preceding period. Figure 2 shows a representative plat of wheat shortly after heading. It also shows the growth of corn at that time.

TABLE 11.—*Acre yields of spring wheat from different methods of production on the Huntley Experiment Farm in 1922 compared with the yields from these methods during the period from 1913 to 1921, inclusive*

Seed-bed preparation	Preceding crop	Number of plats averaged each year	Average yields (bushels)	
			1913 to 1921	1922
Fall plowed	Corn	1	15.2	21.7
Do	Oats	2	13.6	25.6
Do	Wheat	[1] 3	11.6	20.3
Spring plowed	Corn	1	14.9	24.0
Do	Oats	1	10.6	26.7
Do	Wheat	1	9.5	20.7
Do	Flax	[2] 1	11.5	29.5
Subsoiled	Wheat	1	10.8	16.7
Listed	do	1	11.6	29.5
Disked grain stubble	do	[3] 4	6.6	22.3
Disked corn stubble	Corn	[4] 12	15.6	25.3
Fallow	Fallow	[5] 10	20.6	24.7
Green manured with winter rye	Winter rye	1	18.3	25.2
Green manured with peas	Peas	1	20.3	24.3
Green manured with sweet clover	Sweet clover	[2] 1	14.6	26.3
Average of average yields for each year		41	15.8	24.3

[1] 1 plat only previous to 1917.
[2] Begun in 1915.
[3] Begun in 1917.
[4] 8 plats in 1913 and 1914; 12 plats since 1914.
[5] 3 plats in 1913 and 1914; 9 plats in 1915 and 1916; 10 plats since 1916.

Oats.—The Sixty-Day variety of oats was used in the dry-land rotation experiments. The crop responded well to the favorable growing conditions of the season. In the economical use of soil moisture oats exceed wheat in that the yield of straw was not greatly out of proportion to the quantity of grain produced. Although

FIG. 2.—Spring wheat and corn in the dry-land rotation experiments in 1922

lodging was met with in a few instances at harvest time, in no case was the condition serious enough to hinder cutting operations. The condition of a representative plat of oats preceding harvest is shown in Figure 3. The grain on all plats was well filled and of much higher quality than has been grown for several years. Preceding crops and cultivation methods exerted little influence on the oat

yields this season, and the average results obtained were generally not consistent with the average of previous years. Table 12 shows the average yield of oats from the various methods of production.

TABLE 12.—*Acre yields of oats grown on the Huntley Experiment Farm during the periods and under the conditions specified*

Seed-bed preparation	Preceding crop	Number of plats averaged each year	Average yields (bushels)	
			1913 to 1921	1922
Fall plowed	Wheat	[1] 6	32.5	52.6
Do	Barley	1	31.2	53.8
Do	Oats	1	26.1	44.7
Spring plowed	Corn	2	34.9	55.6
Do	Wheat	[2] 2	27.7	66.1
Do	Oats	1	23.0	57.2
Do	Flax	[3] 1	23.4	56.3
Subsoiled	Oats	1	23.9	41.3
Listed	----do	1	29.3	58.8
Disked corn stubble	Corn	[4] 9	34.5	58.0
Fallow	Fallow	3	46.6	65.5
Green manured with winter rye	Winter rye	2	40.2	52.7
Green manured with peas	Peas	2	43.2	43.3
Green manured with sweet clover	Sweet clover	[3] 1	32.0	62.2
Sod crops	Alfalfa	1	28.9	50.0
Do	Bromegrass	1	28.5	56.9
Average of average yields for each year		35	34.2	55.7

[1] 4 plats previous to 1915.
[2] 1 plat previous to 1915.
[3] Begun in 1915.
[4] 8 plats previous to 1915.

Barley.—Compared with the returns of other grain crops for the year, the yield of barley was very low. Indeed, the average yield of all plats was a trifle below the average production of previous years. Cultural methods which have heretofore given the maximum

FIG. 3.—Oats on disked cornland in the dry-land rotation experiments in 1922

yields of barley ranked among the lowest in production this season, and, conversely, some of the generally low-yielding plats made in 1922 the highest returns per acre. These discrepancies can be accounted for in large measure by the fact that where seed-bed and

moisture-storage conditions were particularly favorable, high yields of straw were produced at the expense of grain; but where such favorable conditions did not exist the crop made less vegetative growth and had more moisture available to fill the grain as it approached maturity. The average yield for each method of production in 1922, as well as for previous years, is given in Table 13.

TABLE 13.—*Acre yields of barley grown on the Huntley Experiment Farm during the periods and under the conditions specified*

Seed-bed preparation	Preceding crop	Number of plats averaged each year	Average yields (bushels)	
			1913 to 1921	1922
Fall plowed	Barley	[1] 1	11.6	17.7
Spring plowed	Oats	1	16.2	30.4
Do	Barley	[1] 1	13.1	24.4
Disked flax stubble	Flax	[1] 1	18.3	18.8
Disked corn stubble	Corn	4	22.0	24.7
Fallow	Fallow	[1] 1	11.6	16.0
Green manured with winter rye	Winter rye	1	27.9	19.8
Green manured with peas	Peas	1	29.4	17.3
Average of average yields for each year		11	22.6	22.1

[1] Begun in 1915.

Flax.—Practically all methods of flax production in 1922 returned yields above the average, but this excess was not so great as the favorable season would seem to warrant. Poor stands are partly accountable for the relatively low yields. The flax grew taller and

FIG. 4.—Spring wheat and flax in the dry-land rotation experiments in 1922

matured more uniformly than for several years past. The plats, with the exception of those continuously cropped to flax, were unusually free from weeds in spite of the thin stands. A plat of flax and one of wheat in a 2-year rotation of wheat and flax both on spring plowing are shown in Figure 4. The average yields of flax for the several methods of production are shown in Table 14.

TABLE 14.—*Acre yields of flax grown on the Huntley Experiment Farm during the periods and under the methods specified*

Seed-bed preparation	Preceding crop	Number of plats averaged each year	Average yields (bushels)	
			1913 to 1921	1922
Fall plowed	Corn	[1] 1	6.8	10.5
Do	Flax	[2] 3	7.3	7.1
Spring plowed	Oats	[1] 1	5.7	11.4
Do	Wheat	[1] 1	7.3	13.4
Do	Corn	[1] 2	7.4	14.7
Do	Flax	[2] 2	6.7	10.3
Subsoiled	do	1	5.5	9.6
Listed	do	1	6.4	8.2
Disked corn	Corn	[1] 2	7.1	12.0
Fallow	Fallow	[2] 2	10.7	11.3
Average of average yields for each year		16	7.6	10.7

[1] Begun in 1915. [2] One plat previous to 1915.

Corn.—The growing season of 1922 was generally favorable for the production of corn. Although the early growth of the crop was somewhat retarded by cool weather, the latter part of the season was unusually warm, thus enabling the crop to mature at about the average date. Sufficient moisture was available to promote a comparatively heavy growth of stover and yields of grain above the average. Grasshoppers entered the field in large numbers about the middle of August and damaged the corn to some extent. Plats near the edges of the field were the first to be attacked and suffered the greatest injury. The plat of listed corn was more affected than any of the others, almost half the stalks being stripped of their foliage. The ear corn, however, was too nearly mature to be greatly damaged by the insects. Table 15 presents the average yields obtained with each method of growing the crop.

TABLE 15.—*Acre yields of corn grown on the Huntley Experiment Farm by the methods and for the periods specified*

Seed-bed preparation	Preceding crop	Number of plats averaged each year	Average yields			
			1913 to 1921		1922	
			Grain	Stover	Grain	Stover
			Bushels	*Pounds*	*Bushels*	*Pounds*
Fall plowed	Oats	4	18.4	1,580	21.0	1,942
Do	Spring wheat	2	19.3	1,594	24.3	2,055
Do	Flax	[1] 1	17.8	2,224	23.2	2,730
Do	Winter wheat	[1] 1	29.0	2,517	38.3	3,540
Do	Corn	1	17.2	1,640	22.2	1,800
Spring plowed	Spring wheat	[2] 5	19.4	1,436	28.7	2,536
Do	Oats	[3] 13	20.1	1,676	26.5	2,450
Do	Winter oats	6	19.9	1,640	26.9	2,293
Do	Barley	3	20.0	1,518	29.0	1,680
Do	Flax	[1] 3	17.9	1,798	25.5	2,633
Do	Corn	1	18.1	1,432	25.1	2,290
Subsoiled	do	1	17.5	1,984	21.0	1,990
Listed	do	1	23.7	1,577	33.3	1,600
Fallow	Fallow	1	27.9	2,610	28.2	1,970
Average of average yields for each year		43	20.0	1,674	26.4	2,302

[1] Begun in 1915. [2] Four plats previous to 1915. [3] Nine plats previous to 1915.

Alfalfa.—The nonirrigated alfalfa in these experiments produced higher yields this season than have been obtained for several years. Because of the damage done by grasshoppers in 1921 to the alfalfa seeded in that year, it was necessary to reseed this plat in 1922, and no yield was obtained from it. The alfalfa seeded in 1920 yielded one cutting of hay at the rate of 3,300 pounds per acre. The average yield of second-year alfalfa has heretofore been 1,246 pounds per acre.

Bromegrass.—Yields of bromegrass hay were much higher in 1922 than usual. The plat which has been in bromegrass for two years produced 2,000 pounds of hay per acre, while the 3-year-old plat returned 2,900 pounds of hay per acre. The previous average for the 2-year-old and 3-year-old plats was 576 and 753 pounds per acre, respectively.

EXPERIMENTS IN PASTURING DRY-LAND CROPS WITH HOGS

The use of various dry-land grain and forage crops for hog pasture has been under investigation at this farm since 1915. This work is conducted with a view to ascertaining which crops are best suited to pasturing, both in giving palatable and nutritious forage and in lending themselves to a rotation or cropping sequence capable of furnishing continuous pasture throughout the season. Information as to the relative carrying capacity of an acre of these crops, the economic merits of pasturing as contrasted with harvesting the crops by machinery, and the effect of pasturing on the growth of succeeding crops is also obtainable from these experiments.

Both annual and perennial crops are used. The annual crops are represented by 1 acre each of winter rye, field peas, beardless barley, and corn. These are arranged in a rotation and become available for grazing in the order named. The perennial crops used are alfalfa and bromegrass. These plats are not grazed in rotation, but are pastured continuously from the time the hogs are put on in the spring until the lack of forage or its unpalatability necessitates their removal. Three of the perennial pastures used in 1922 were half an acre in area, and a fourth plat comprised a quarter acre.

In addition to the plats pastured, check plats of the same crops are harvested by machinery. Likewise, in 1922, a check lot of hogs was fed a full ration of corn and tankage in a dry lot, and their performance was compared with that of the hogs on pasture.

Annual crops.—The 1922 pasture season for the annual crops opened May 24, when 10 fall pigs averaging 104.4 pounds each were placed on the plat of winter rye. This date is somewhat later than usual, owing largely to the fact that the fall-sown rye did not come up until April 20. While on pasture the pigs were fed a daily ration of shelled corn amounting to 2 pounds of corn for every 100 pounds of live weight. The animals were weighed every two weeks, and the supplementary grain ration was calculated from the weights obtained. The growth of rye was sufficient to carry the 100 pigs for 37 days. This was 14 days less than the previous average of the experiment. Average gains in weight amounted to 0.59 pound per pig each day while on the rye. Heretofore the average daily gain has been 0.58 pound. A total of 848 pounds of corn was fed as a supplement to the pasture. On the basis of gains made the corn was consumed at the rate of 3.89 pounds of grain for each pound of gain in weight.

This grain ratio is about half a pound of corn less per pound of gain than the average performance of hogs on rye pasture.

The check lot of hogs receiving a full ration of corn in a feed pen without pasture averaged 1.37 pounds of gain per day. In this lot it required 4.19 pounds of corn to make a pound of gain. Comparing the results obtained from the two lots of pigs, it was calculated that the rye pasture replaced 65.4 pounds of corn during the period. The check plat of rye which was harvested and threshed yielded 24.8 bushels of grain to the acre.

From the rye pasture the 10 pigs were moved on June 30 to an acre plat of field peas. On this date the peas were fully blossomed and a few pods were forming. Ordinarily the pea pasture has not been grazed until a large percentage of the crop is in pod. While on peas the hogs have continued to receive the 2 per cent supplementary ration of corn.

After a period of but 11 days the pigs were taken from the plat of peas and placed on a plat of Success barley. Although the acre of

FIG. 5—Sows and pigs pasturing peas on dry land on the Huntley Experiment Farm in 1922

peas was not fully grazed off in the period allowed, the move to the barley pasture was necessary in order that the animals might be given an opportunity to harvest this crop before it matured. The pea forage remaining on the plat of peas was utilized by 2 sows and 14 suckling pigs, which allotment the crop supported for 20 days. The sows and pigs feeding on the peas are shown in Figure 5. The average length of time an acre of peas has carried 10 pigs in this experiment is 17 days. If the removal of the 10 pigs to the barley plat had not been called for, the pea crop of 1922 would have carried the animals for a period well beyond the average.

The average daily gain made was 0.78 pound. This was low compared with the average of other years, which was 1.18 pounds. The deficiency, however, was due largely to the fact that the pigs were removed before the crop had formed much seed. Formerly it required an average of 2.83 pounds of corn fed as a supplement on pea pasture to produce a pound of gain. This year the corn con-

sumed was 3.58 pounds to a pound of gain. Compared with the behavior of the hogs in the check lot, the acre of peas replaced 52.46 pounds of corn during the 11 days. The yield on the check plat of peas was greatly reduced by a storm, and only 5.4 bushels of threshed peas were obtained from the acre.

The barley pasture, beginning July 11, covered a period of 22 days. Although the hogs were placed on this forage when the grain was still soft, the crop ripened before much of it had been eaten, and the resulting gains averaged but 0.36 pound daily per pig. This return corresponded closely to the average obtained for preceding years, which is 0.35 pound per day. In this experiment the pigs have seldom made good gains on barley. When ripe the grain appears to be too hard for them to masticate, and much of it is lost. Hence, the practice has been to pasture as much of the crop as possible while the grain is in the soft-dough stage. This system has removed to a large extent the difficulty encountered from the hard grain. Another factor which may contribute to the poor returns made by pasturing barley is the comparative bulkiness of the feed obtained by this method. A large proportion of the material consumed is made up of hulls, chaff, and similar roughage and has little or no nutritive value. However, when the gains made by the hogs on barley this year are compared with the gains made by the hogs in the dry lot, it is found that the barley had a replacement value of 331.01 pounds of corn. The barley on the check plat yielded 31 bushels to the acre. From the plat of barley the 10 pigs were removed to a dry lot to be fattened for market. Table 16 presents the data obtained from the time the 10 pigs were placed on the plat of rye until they were ready for market. The performance of the check lot of hogs during the season is also shown.

One acre of Northwestern Dent corn, the fourth crop of the 4-year rotation of annual crops to be pastured, was stocked September 13 with eight spring pigs averaging about 70 pounds each.

TABLE 16.—*Results obtained on the Huntley Experiment Farm from hogs pastured on dry-land winter rye, peas, and barley and finished in a dry lot compared with those from hogs grown on a full feed of corn and tankage without pasture*

Items of comparison	Rye	Peas	Barley	Finishing period on dry lot	Dry-lot check
Area of plat—acres	1	1	1		
Test began	May 24	June 30	July 11	Aug. 2	May 24
Test ended	June 30	July 11	Aug. 2	Sept. 14	July 30
Length of test—days	37	11	22	43	67
Number of hogs	10	10	10	[1] 9	10
Total weight:					
Initial—pounds	1,044	1,262	1,348	1,246	1,063
Final—do	1,262	1,348	1,427	1,913	1,981
Gain—do	218	86	79	667	918
Average weight:					
Initial—do	104.4	126.2	134.8	138.4	106.3
Final—do	126.2	134.8	142.7	212.5	198.1
Average gain:					
Per pig—do	21.8	8.6	7.9	74.1	91.8
Daily, per pig—do	.59	.78	.36	1.72	1.37
Grain ration fed	[2]	[2]	None.	[3]	[3]
Total grain fed—pounds	848	308		2,777	3,849
Grain fed per 100 pounds of gain—do	389	358		416	419
Grain replaced by 1 acre of pasture—do	65.40	52.46	331.01		
Yield of grain from 1 acre of check plat—bushels	24.8	[4] 5.4	31.0		

[1] One pig removed because of lameness.
[2] Corn, 2 per cent.
[3] Corn and tankage self-fed.
[4] Yield reduced by storm.

The corn was practically mature on this date and was readily eaten by the animals. Alfalfa hay was available to the pigs as a supplement while they were on the pasture, but they consumed only 130 pounds of it before the season ended on October 14. During the 31-day pasture period the pigs made an average daily gain of 0.94 pound. This is somewhat less than has been obtained previously, the average for the four years, 1916, 1917, 1918, and 1920, in which a crop of corn was produced and hogged off being 1.19 pounds per day for an average period of 20 days.

Perennial crops.—Half an acre each of alfalfa sown in rows 2 feet apart and alfalfa sown broadcast with a drill was pastured by hogs during the 56-day period between May 24 and July 19. Three fall pigs were allotted to each plat. The lot on the row plat averaged 109 pounds, while the lot on the broadcast plat averaged 76 pounds. A ration of corn equivalent to 2 pounds to each 100 pounds of live weight was fed daily to both lots while on pasture. An average daily gain of 0.92 pound per pig was made on the row plat and 0.82 pound per pig on the broadcast plat. On the row plat 3 pounds of corn were fed for each pound of gain and 2.45 pounds of corn for each pound of gain on the broadcast plat. Hogs in a check lot on a self-fed ration of corn and tankage made an average daily gain of 1.37 pounds at an outlay of 4.19 pounds of corn for each pound of gain. The grain replacement value of the row-alfalfa pasture was at the rate of 366 pounds of corn per acre, while that on the broadcast plat of alfalfa was 484 pounds of corn. The returns on alfalfa pasture this season closely approximated the average returns of previous years.

During the 56-day period from May 24 to July 19, half an acre of bromegrass seeded in rows 2 feet apart was pastured by three fall pigs, and a quarter acre of bromegrass seeded broadcast was pastured by two fall pigs. At the beginning of the test the pigs on the row plat averaged 103 pounds, while the pigs on the broadcast plat averaged 93 pounds. A 2 per cent ration of corn was fed to the animals during the pasture season. At the end of the pasture period it was found that the hogs in the row plat had made an average daily gain of 0.82 pound, whereas the lot on the broadcast plat had made but 0.61 pound a day each. The corn fed as supplement averaged 3.29 pounds to a pound of gain on the row plat and 3.55 pounds on the broadcast plat. These gains were somewhat more expensive than the experiment has averaged previously. The same check lot of hogs was used as a basis of comparison with the bromegrass pasture pigs that was used for the alfalfa-pasture pigs. The corn replacement value of the row plat of bromegrass pasture was 247 pounds per acre, while that of the broadcast bromegrass pasture was 172 pounds per acre.

EXPERIMENTS WITH DAIRY CATTLE [3]

Experiments with dairy cattle in 1922 included pasture carrying-capacity tests and methods of feeding cows. The pasturing experiment included tests of the value of top-dressing pastures and a test to determine the maximum carrying capacity of an acre of irrigated

[3] This report was prepared by Thomas W. Moseley, who was detailed by the Dairy Division of the Bureau of Animal Industry to have charge of the work with dairy cattle.

pasture. Feeding experiments were conducted to determine the relative economy of production of cows when fed on roughage alone as compared with feeding both a limited and a full feed of grain in addition to roughage.

As a part of the dairy work of the station in developing proved sires, an experiment of much value to local farmers is being conducted. Purebred Holstein bulls from the station herd are lent to farmers on the Huntley project and in other parts of the Yellowstone and Big Horn Valleys. In herds where such bulls are in use farmers are required to keep production records of their cows, as well as to retain in their herds through at least one lactation period all heifers sired by these bulls. During the year 18 of these bulls were in use in about 40 herds. This work was begun in 1918 when four bulls were put out from the farm, and in most cases where animals sired by these bulls have come into production there is a notable improvemen in these heifers over their dams.

PASTURING EXPERIMENTS WITH DAIRY COWS

Experiments to determine the grasses or mixtures of grasses best suited for pastures were begun in 1911. These experiments consisted at first of tests of a large number of grasses and clovers seeded both separately and in mixtures. From the results of these preliminary tests three pasture mixtures were selected and seeded in a method-of-seeding test on 24 quarter-acre plats in 1916. These mixtures and the rate of seeding of each of the grasses and clovers are stated in Table 17.

TABLE 17.—*Pasture mixtures and rates of seeding in a test of top-dressing with barnyard manure on the Huntley Experiment Farm in 1921 and 1922*

Pasture mixture	Rate per acre of seeding (pounds)		
	Mixture No. 1	Mixture No. 2	Mixture No. 3
Seeded in 1916:			
Awnless bromegrass	2	2	
Orchard grass	5	5	5
Tall fescue	3	3	3
Perennial ryegrass	3	3	
Kentucky bluegrass	4	4	4
White clover	2		2
Alsike clover	2		2
Seed per acre	21	17	16

These pastures were used for three years, 1918 to 1920, in carrying-capacity tests with dairy cattle and during 1921 and 1922 in a pasturing test to determine the effect of top-dressing pastures with barnyard manure.

In the experiment from 1918 to 1920, inclusive, it was found that these pastures had an average carrying capacity of 1.8 cows per acre over an average grazing season of about 141 days (see fig. 6) and that there were but slight differences in the production of pastures seeded to the various mixtures.

THE EFFECT OF BARNYARD MANURE AS A TOP-DRESSING ON IRRIGATED GRASS PASTURES

In some of the earlier experiments with pasture grasses it was found that the top-dressing of pastures with barnyard manure was very effective in increasing growth. To determine the value of maintaining or improving pastures by applications of barnyard manure an experiment was started in 1921. For this experiment the pastures seeded in 1916, which had been used in a comparative carrying-capacity test of three mixtures, were used. These pastures were refenced and divided into two 3-acre fields. Each field was again divided to permit alternate grazing and irrigating.

One pasture, designated as pasture A, was top-dressed with manure at the rate of 12 loads per acre late in the fall of 1920 and again in the fall of 1921, but pasture B did not receive the top-dressing. In order to distribute the manure evenly and mix it with the soil, the manured pasture was harrowed early each spring. The untreated pasture was also harrowed the same day.

FIG. 6.—Cows on an irrigated pasture. The carrying capacity of this pasture was at the rate of about 1.8 cows per acre over an average grazing season of 141 days during three years

Irrigation water was applied during the grazing season at intervals of 10 to 14 days. It was the object at all times to keep the surface soil thoroughly supplied with moisture, and the irrigations, though frequent, were comparatively light. It was observed that whenever pastures were grazed too closely they were slow to resume growth after the cows were removed, and maximum growth was attained by not overgrazing.

During the seasons of 1921 and 1922 the pastures were seriously damaged by grasshoppers. Arsenic-bran mash was applied as a control measure, great care being taken to spread it evenly and finely, so that no large particles that might be eaten by the cattle would remain on the ground. The pastures were irrigated before the cows were returned, and no noticeable effect of the poison was seen on the stock.

The cows used in this experiment were purebred and grade Holsteins and were all mature animals. Since not enough cows in milk were available, it was necessary to use a few that were dry during the course of the experiment. The cows were selected so each group was approximately equal in production, length of lactation period, weight, and date of calving.

In 1921 the pasture season began on May 19 and continued 135 days. At the beginning of the test 6 cows were placed on each of the manured and unmanured plats. On June 7, 4 cows were added to pasture A group, since it was found that the production of the pasture was more than sufficient for the 6 cows. The 10 cows remained until June 18, when 5 of them were removed. On June 24 it became necessary to remove 3 more because of poor growth of the pasture resulting from grasshopper damage.

Pasture B carried 6 cows until June 16, when 1 cow was removed; 3 more were removed June 24, leaving 2 cows from this date until the end of the pasture season. During the last month of the experiment all the cows received a small feed of alfalfa and green corn daily.

In 1922 the pasture season started on May 18. Six cows were placed in each group. This number not being sufficient to consume all the grass, 1 cow was added to each group on June 11, and on June 18, 2 more cows were added to group A and 1 to group B.

The pasture season lasted 136 days, closing September 30. The top-dressed pasture A carried the equivalent of one cow for 666 days while the unmanured pasture B supported the equivalent of one cow for 578 days. This is a difference of 88 days in favor of the manured pasture, or an increase of 15.2 per cent. For the pasture season of 136 days the A pasture averaged 1.63 cows per acre and the B pasture only 1.41 cows per acre.

The results of this test for the two years are given in Table 18.

TABLE 18.—*Results of an experiment in pasturing dairy cows on a pasture top-dressed with manure in comparison with a pasture not top-dressed, on the Huntley Experiment Farm in 1921 and 1922*

Items of comparison	Pasture A, manured			Pasture B, unmanured		
	1921	1922	Average	1921	1922	Average
Length of grazing season—days	135	136	135.5	135	136	135.5
Cows on pasture—do	130	117	123.5	130	117	123.5
Cows off pasture—do	5	19	12	5	19	12
Average daily number of cows per acre	1.09	1.91	1.50	0.97	1.66	1.31
Alfalfa hay fed to cows while off pasture—pounds	591	1,085	838	506	854	730
Green corn fed to cows while off pasture—do	541	None.	270	559	None.	279
Average weight per cow for season—do	1,149	1,197	1,173	1,158	1,269	1,213
Average gain in weight during season:						
Per acre—do	71	83	77	66	−118	−26
Per cow—do	65	43	54	68	−71	−1.5
Production per acre:						
Milk—do	3,109	4,558	3,833	3,528	4,080	3,804
Butterfat—do	117.5	158.6	138.0	122.9	159.2	141.0

The results of the two years' experiments show that the manured pasture increased in carrying capacity about 14 per cent over the pasture that was unmanured.

MAXIMUM CARRYING CAPACITY OF AN ACRE OF IRRIGATED PASTURE

In order to determine the maximum carrying capacity of an acre of irrigated pasture a test was begun in 1918 with 1 acre of pasture that was seeded in 1916 to the following mixture: Awnless bromegrass 2 pounds, orchard grass 5 pounds, tall fescue 3 pounds, perennial ryegrass 3 pounds, Kentucky bluegrass 4 pounds, white clover 2 pounds, and alsike clover 2 pounds. This pasture received a top-

dressing of manure at the rate of 12 loads per acre each fall from 1917 to 1921, inclusive. The pasture was divided to permit alternate grazing and irrigating.

In 1919 the pasture season began on May 8 and extended to September 28, a period of 144 days. In 1920 the season lasted 137 days, or from May 14 to September 27. In 1921 the pasture season extended from May 19 to September 30, a total of 135 days. In 1922 the season lasted from May 18 to September 30, or 136 days. The average grazing season was 138 days.

At the beginning of the season in 1922 three cows were placed on the pasture, which furnished sufficient grazing until July 9, when one cow was removed. The two cows remained until September 12, when a second cow was removed. Grasshoppers damaged the pasture to some extent and lessened its carrying capacity. The results of four years in this test are given in Table 19.

TABLE 19.—*Carrying capacity of an acre of irrigated pasture on the Huntley Experiment Farm from 1919 to 1922, inclusive*

Items of comparison	1919	1920	1921	1922	Average
Length of grazing season.....days..	144	137	135	135	138
Cows on pasture.....do....	137	133	122	132	132
Cows off pasture.....do....	7	3	12	3	6
Average daily number of cows per acre.....	1.98	2.06	2.00	2.13	2.04
Alfalfa hay fed while off pasture.....pounds..	768	751	1,222	1,870	1,153
Green corn fed to cows while off pasture.....do....	.....	.....	1,850	.....	462
Grazing period of cows on outside pasture.....days..	.....	6	5	.....	.....
Average weight per cow for season.....pounds..	1,170	1,117	1,185	1,265	1,184
Average gain in weight during season:					
Per acre.....do....	118	172	181	−43	107
Per cow.....do....	59	83	90	−20	53
Production per acre:					
Milk.....do....	5,992	6,344	8,438	8,225	7,249
Butterfat.....do....	199.1	304.6	330.9	307.5	285.5

The average carrying capacity of the acre of irrigated pasture from 1919 to 1922, inclusive, was 2.04 cows for 137 days.

METHODS OF FEEDING DAIRY CATTLE

An experiment was begun in 1918 to obtain some information as to the economy of production from dairy cows when fed roughage alone, as compared with giving a full feed consisting of roughage and grain, and also the production of the same cows when fed a limited grain ration in addition to the roughage. This experiment constitutes a part of a more extensive investigation being conducted by the Bureau of Dairying, formerly the Dairy Division of the Bureau of Animal Industry, and the following is only a preliminary report, but the results so far give some indication as to the production of cows when fed roughage alone as compared with a full feed. Seven cows have completed a year's test on roughage alone and also a year on full feed of grain and roughage. The roughage fed in summer consisted of irrigated grass pasture and alfalfa hay. In winter, hay, corn silage, and a limited ration of roots were fed. The grain consisted of a standard mixture fed at the rate of about 1 pound of grain to 3 pounds of milk produced. The cows in each part of the experiment were milked three times daily. The results of the test are given in Table 20.

TABLE 20.—*Results of tests with cows fed roughage alone as compared with a full feed of grain and roughage on the Huntley Experiment Farm*

Cow	Test made	Feed consumed (pounds)					Pasture (days)	Production (pounds)	
		Hay	Silage	Roots	Grain	Beet pulp		Milk	Butterfat
No. 208	Roughage	9,339	8,680	4,620			126	11,023.4	388.832
	Full feed	9,694	7,170	4,620	5,358		70	14,154.5	430.480
No. 1	Roughage	7,755	7,798	2,745			128	12,401.4	486.363
	Full feed	9,569	6,280	4,815	5,929		71	15,129.2	523.230
No. 211	Roughage	9,715	10,956	2,030			123	15,122.1	488.511
	Full feed	10,414	7,915	4,625	6,261		107	20,345.9	638.536
No. 204	Roughage	9,014	8,985				140½	14,312.1	470.030
	Full feed	10,093	8,325	4,230	7,056		13	25,499.4	823.110
No. 9	Roughage	5,030	11,252	1,970		320	133	11,066.4	396.479
	Full feed	8,629	6,727	2,870	4,529	348	122	12,873.6	477.917
No. 6	Roughage	4,789	12,132	1,970		320	133	10,094.9	459.102
	Full feed	7,589	6,832	2,905	4,613		97	12,721.7	530.610
No. 8	Roughage	5,142	11,525	1,970		320	131	13,262.4	486.826
	Full feed	8,264	6,975	4,485	5,161		69	13,838.2	487.020
Total:									
Roughage		49,784	71,328	15,305		960	914	87,182.7	3,176.143
Full feed		64,252	50,224	28,550	38,907	348	666	114,562.5	3,910.903
Average:									
Roughage		7,112	10,189	2,186		137	130	12,454.6	453.734
Full feed		9,179	7,174	4,078	5,558	49	95	16,366.0	558.700

Table 20 indicates that the average consumption of roughage for the cows in the roughage-feeding test was 7,112 pounds of alfalfa hay, 10,189 pounds of corn silage, 2,186 pounds of roots, and 137 pounds of wet beet pulp. During the year they were on pasture 130 days. The average production of the cows in the roughage test was 12,454.6 pounds of milk, containing 453.734 pounds of butterfat. When these same cows were fed all the grain they would consume, together with all the roughage they desired ,they received 9,179 pounds of alfalfa hay, 7,174 pounds of corn silage, 4,078 pounds of roots, 49 pounds of wet beet pulp, and 5,558 pounds of grain. During the year they were on pasture 95 days. These cows produced an average of 16,366.0 pounds of milk, containing 558.7 pounds of butterfat. This is an increase in average production of 3,911.4 pounds of milk and 104.966 pounds of butterfat.

Although the cows on full feed consumed more alfalfa hay than when in the roughage test, it should be noted that they were on pasture an average period of 35 days less than when on roughage alone and that the difference in hay consumption is probably accounted for by this difference in the length of time on pasture. The variation in the quantity of roots consumed is due to a variation in the available supply. The cows at all times consumed all the roots fed to them. Under local conditions, where it is possible to produce relatively cheap alfalfa hay and corn silage of excellent quality and where grain is comparatively high in price, it would appear that more economical production may be attained when cows are fed only roughage.

The cows fed a full feed of grain gained in weight. The roughage cows lost weight after the first few months, but later regained what they had lost and finished their test with an average weight about the same as when they started.

FEEDING EXPERIMENTS WITH HOGS[4]

Hog-feeding experiments were begun in 1917. This work is carried on in cooperation with the Animal Husbandry Division of the United States Department of Agriculture and the Montana Agricultural Experiment Station.

The investigations conducted in 1922 included the following tests: (1) A comparison of a varying grain ration with an unchanging ration for spring pigs on alfalfa pasture; (2) a test to determine the value of skim milk as a substitute for grain for pigs on alfalfa pasture; and (3) a comparison of the feeding value of native-grown corn with corn grown in the Corn Belt.

A VARYING GRAIN RATION COMPARED WITH A STATIONARY RATION FOR SPRING PIGS ON ALFALFA PASTURE

Two lots of 12 pigs each were placed on half-acre plats of alfalfa pasture on June 24, where they remained until October 5 (inclusive), the close of the pasture season. Lot 1 received what is known as a 2 per cent ration of grain, or 2 pounds of grain for each 100 pounds of live weight of hogs. The animals in this lot were weighed at the beginning of the experiment, and during the first two weeks of the test these pigs were fed 2 pounds of shelled corn daily for each 100 pounds of live weight, as shown by the initial weighing. During the time this experiment was in progress the hogs were weighed every 14 days, and from these weights the grain ration for the succeeding two weeks was calculated. Thus the pigs always received as nearly as possible 2 pounds of corn daily for each 100 pounds of live weight. At the beginning of the test the pigs in lot 1 were fed 9½ pounds of grain daily, and at the close of the pasture season this had been increased to 22 pounds per day.

TABLE 21.—*Results from feeding a varying grain ration as compared with a stationary grain ration to supplement alfalfa pasture for spring pigs on the Huntley Experiment Farm in 1922*

Items of comparison	Daily corn ration	
	Lot 1, 2 per cent corn	Lot 2, 1½ pounds per pig
Number of pigs	12	12
Pasture period ..... days	104	104
Dry-lot period ..... do	68	68
Total period ..... do	172	172
Average initial weight ..... pounds	39.6	38.9
Average weight at end of—		
Pasture season ..... do	93.2	96.6
Dry-lot period ..... do	198.2	205.9
Average daily gain:		
On pasture ..... do	.52	.56
In dry lot ..... do	1.54	1.61
Entire period ..... do	.92	.97
Feed for each 100 pounds of gain:		
On pasture ..... do	241	263
On dry lot ..... do	418	412
Entire period ..... do	358	360

The 12 pigs in lot 2 were similar to those in lot 1 and were fed a daily ration of 1½ pounds of grain per pig per day throughout the entire test, regardless of the initial weight of the animals or their gain in weight as the season advanced.

[4] This report was prepared by Robert E. Hutton, who was detailed by the Animal Husbandry Division of the Bureau of Animal Industry to have charge of the work with hogs.

While on pasture the pigs in lot 2 made 4.1 pounds more gain per pig during the pasture season, but required 22 pounds more grain to produce 100 pounds of gain in weight than the pigs in lot 1.

At the close of the pasture season each lot of pigs was removed to a dry lot and given a self-fed ration of corn and tankage. By December 12 they had reached an average weight of 201 pounds and were ready for market. The pigs in lot 2 made slightly faster and more economical gains during the 68-day period in the dry lot than did those in lot 1, so that for the entire feeding period the cost of producing a finished pig was practically the same for both lots, as shown in Table 21.

SKIM MILK AS A SUBSTITUTE FOR GRAIN FOR SPRING PIGS ON ALFALFA PASTURE

An experiment was begun on June 24 to determine the value of skim milk as compared with grain as a supplement for pigs on alfalfa pasture. The test consisted of three lots of 12 pigs each, each lot being grazed on half an acre of alfalfa. Lot 1 received a 2 per cent corn ration, the pigs being weighed every two weeks and the daily ration adjusted after each weighing. Lot 2 received half as much corn daily as lot 1 and 4 pounds of skim milk for each pound of grain. Lot 3 received 4 pounds of skim milk daily for each pound of grain fed lot 1. Thus for lot 2, half of the weight of grain fed lot 1 was replaced by milk at the rate of 4 pounds to 1 pound of grain, and in lot 3 the full quantity of corn fed lot 1 was replaced with skim milk on this basis. The pigs in lot 3 made very little gain and became unthrifty in appearance, having pot-bellies and very rough coats. The pigs in lot 2, in which only half the corn was replaced with skim milk, made fair gains, but not equal to the gains in lot 1, which received corn alone. It would seem from this experience that skim milk and alfalfa pasture made a ration of so much bulk that spring pigs have not the capacity to assimilate sufficient quantities of it to promote thrift and economical growth. As a result of this preliminary test it would seem probable that skim milk would be better used as a substitute for pasture rather than as a substitute for grain with pigs on pasture. However, more data must be obtained before any definite conclusions can be drawn.

The results with the different lots are shown in Table 22.

TABLE 22.—*Results obtained with corn as compared with skim milk when fed to pigs as supplements to alfalfa pasture on the Huntley Experiment Farm in 1922*

[The pigs in lot 1 were fed a supplementary ration of 2 per cent corn; those of lot 2 were fed half as much corn as was fed to lot 1, together with 4 pounds of skim milk for each pound of corn; those of lot 3 were fed 4 pounds of skim milk for each pound of corn fed to lot 1]

Items of comparison		Lot 1	Lot 2	Lot 3
Number of hogs		12	12	12
Length of test	days	104	104	104
Average weight:				
Initial	pounds	39.6	40.2	39.9
Final	do	93.2	85.2	64.8
Average gain:				
Per pig	do	53.6	45.0	24.9
Daily, per pig	do	.52	.43	.24
Feed per 100 pounds of gain:				
Corn	do	241	144	
Skim milk	do		575	2,109
Milk required to replace 100 pounds of corn	do		591	873

COMPARISON OF NORTHWESTERN DENT AND NO. 2 YELLOW CORN AS FEED FOR HOGS

On October 24 two lots of 12 pigs each were started on a test of Northwestern Dent corn, a variety which has proved to be one of the most satisfactory for this locality, as compared with commercial No. 2 Yellow corn produced in the Corn Belt. Each lot of pigs was self-fed corn and tankage. One lot received the yellow corn, while the other received Northwestern Dent corn. The lot which was fed No. 2 Yellow corn made an average daily gain of 1.6 pounds per pig and required 392 pounds of feed to produce 100 pounds of gain in weight; the lot fed Northwestern Dent corn made a daily gain of 1.49 pounds and required 430 pounds of feed to produce 100 pounds of gain in weight. On this basis 109 pounds of Northwestern Dent corn are equal in feeding value to 100 pounds of No. 2 Yellow corn.

CROP-UTILIZATION EXPERIMENTS [5]

PASTURING ALFALFA WITH HOGS

In rotation 67, field K, and in rotation 69, field L–IV, quarter-acre plats of third-year alfalfa are pastured with hogs. The pasturing season is divided into two periods, from May to July with fall pigs and from July to August with spring pigs. Each plat is divided into two equal areas, and the hogs are alternated from one area to the other every 10 or 12 days, thus giving them frequent access to new-growth alfalfa. The pigs are weighed every 14 days, and with these weights as a basis they are fed a daily ration of 2 pounds of corn for each 100 pounds of live weight.

TABLE 23.—*Results of pasturing pigs on alfalfa on the Huntley Experiment Farm during the 9-year period from 1914 to 1922, inclusive*

[The calculations are reduced to an acre basis]

Year	Rotation No.	Number of pigs		Number of days	Weight of pigs (pounds)				Corn fed per pound of gain (pounds)
		Spring	Summer		Initial	Final	Grain		
							Total	Average daily per pig	
1914	67	16	36	138	3,272	5,572	2,300	0.42	2.78
1915	67	20	32	150	4,364	6,840	2,476	.70	3.13
1916	67	20	32	145	3,520	6,552	3,032	.85	2.79
1917	67	16	36	150	3,280	5,460	2,180	.74	2.87
	69	20	32	152	3,288	5,768	2,480	.72	2.64
1918	67	20	32	148	3,200	5,560	2,360	.66	2.72
	69	20	32	148	3,216	5,464	2,248	.63	2.85
1919	67	20	32	159	3,720	6,196	2,476	.57	2.99
	69	20	32	161	3,700	5,796	2,096	.48	2.45
1920	67	20	32	134	2,812	4,752	1,940	.56	2.57
	69	20	32	131	2,772	4,552	1,780	.55	2.83
1921	67	16	32	125	3,860	5,864	2,004	.67	3.02
	69	16	32	125	3,868	5,880	2,012	.66	3.00
1922	67	20	32	133	3,652	6,016	2,364	.69	2.79
	69	20	32	133	3,692	6,088	2,396	.70	2.77
Average		18	32	142	3,481	5,757	2,276	.64	2.81

This experiment was begun in 1914 in rotation 67 and in 1917 in rotation 69. The results of the experiment during this period are given in Table 23.

[5] These experiments, while supervised by Mr. Hutton of the Division of Animal Husbandry, are not a part of the investigations relating to swine production, but are part of the agronomic investigations in which hogs are used to harvest crops. It is not to be inferred that the methods and rates of pasturing used in these experiments are the ones best suited to or recommended for general use in the region.

In 1922, check lots of similar pigs for both the spring and summer period were given a self-fed ration of corn and tankage in the dry lot, thus affording a test of dry-lot feeding as compared with pasture feeding. From the results of this experiment an idea of the quantity of concentrates saved by the alfalfa pasture is obtained. (Table 24.)

TABLE 24.—*Results with pigs on alfalfa pasture in the rotation experiments in comparison with pigs in a dry lot, on the Huntley Experiment Farm in 1922*

Items of comparison	Spring period			Summer period		
	Field K	Field L	Dry lot (check)	Field K	Field L	Dry lot (check)
Number of hogs	5	5	10	8	8	12
Length of test—days	69	69	67	64	64	64
Average weight:						
Initial—pounds	118.8	119.6	106.3	39.9	40.6	41.2
Final—do	178.2	181.8	198.1	76.6	76.6	89.4
Average gain:						
Per pig—do	59.4	62.2	91.8	36.7	36.0	48.2
Daily per pig—do	.86	.91	1.37	.58	.57	.75
Feed per 100 pounds of gain—do	351	335	419	206	215	433
Grain saved by 1 acre of pasture—do	808	1,045	----------	2,668	2,511	----------
Pork produced by 1 acre of pasture—do	192	249	----------	616	580	----------

Based on the gains made by the check lot of pigs, the pasture in field K saved 68 pounds of corn for each 100 pounds of gain in weight made by the fall pigs during the spring period and 227 pounds of corn for each 100 pounds of pork produced by the spring pigs during the summer pasturing season. In field L the pasture saved 84 pounds of corn for each 100 pounds of gain in weight of the fall pigs and 218 pounds of corn per 100 pounds of gain in weight for the spring pigs. Thus an acre of pasture in field K replaced 808 pounds of corn for the 69 days of pasturing by fall pigs and 2,668 pounds of corn in the 64 days it was pastured with spring pigs, making a total of 3,476 pounds of corn replaced by 1 acre of pasture during the season. Similar figures for field L are 1,045 pounds of corn saved per acre in the spring period and 2,511 pounds in the summer period, making a total of 3,556 pounds of corn saved per acre.

TABLE 25.—*Results of hogging off corn on the Huntley Experiment Farm durin[7] the 11-year period from 1912 to 1922, inclusive*

[Calculations reduced to an acre basis]

Year	Number of hogs	Number of days	Weight (pounds)				Estimated yield (bushels)
			Hogs			Grain fed per 100 pounds of gain	
			Initial	Final	Total gain		
1912	20	16	2,900	3,228	388	530	36.4
1913	16	23	1,312	2,080	768	440	60.0
1914	16	22	1,380	2,276	896	320	50.4
1915	16	25	1,376	2,240	864	450	52.4
1916	16	20	1,516	2,188	672	500	60.0
1917	16	24	1,200	1,828	628	380	43.2
1918	16	27	1,428	2,152	724	510	65.0
1919	16	27	1,636	2,112	476	410	55.0
1920	32	22	2,652	3,444	792	469	66.4
1921	32	18	2,916	3,572	656	592	72.3
1922	32	28	2,452	3,384	932	492	82.0
Average	21	23	1,888	2,597	709	463	58.4

PASTURING CORN WITH HOGS

The spring pigs used in the alfalfa pasturing experiment in rotation 67 are used to hog-off a quarter-acre plat of corn in the same rotation as soon as the summer pasturing period of the alfalfa is completed.

Table 25 gives the results obtained from corn for the 11 years, 1912–1922, on an acre basis.

In rotation 69, field L–IV, Dwarf Essex rape is drilled between the corn rows about July 20 at the rate of 8 pounds per acre. Table 26 shows the results of hogging off corn and rape for the 7-year period from 1916 to 1922.

TABLE 26.—*Results of hogging off corn and rape on the Huntley Experiment Farm for the 7-year period from 1916 to 1922, inclusive*

[Calculations reduced to an acre basis]

Year	Number of hogs	Number of days	Weight (pounds)				Estimated yield (bushels)
			Hogs			Grain fed per 100 pounds of gain	
			Initial	Final	Total gain		
1916	8	38	660	1,246	586	485	50.8
1917	16	32	1,168	1,700	532	433	41.4
1918	16	36	1,156	1,964	808	380	55.0
1919	16	29	1,116	1,930	814	241	60.0
1920	16	39	1,198	2,038	840	392	57.7
1921	16	43	1,474	2,228	754	497	64.5
1922	16	40	1,226	2,068	842	498	74.6
Average	15	36	1,142	1,882	740	418	57.7

Table 27 gives a comparison of the results of hogging off corn with rape for 7 years and for 11 years of corn without rape.

TABLE 27.—*Comparison of the results of pasturing corn with rape for 7 years and of corn without rape for 11 years on the Huntley Experiment Farm*

[Calculations reduced to an acre basis]

Items of comparison	Average results	
	11 years without rape	7 years with rape
Number of hogs per acre	21	15
Length of test—days	23	36
Total weight:		
Initial—pounds	1,888	1,142
Final—do	2,597	1,882
Gain—do	709	740
Yield of corn (estimated)—bushels	58.4	55.7
Estimated grain fed per 100 pounds of gain—pounds	463	418

A comparison of the results obtained from hogging corn and rape with those of hogging corn without rape shows that there is an advantage in favor of the corn and rape. The estimated grain per 100 pounds of gain for the corn and rape is 418 pounds, as compared with 463 pounds without rape.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

June 20, 1925

Secretary of Agriculture	W. M. Jardine.
Assistant Secretary	R. W. Dunlap.
Director of Scientific Work	E. D. Ball.
Director of Regulatory Work	Walter G. Campbell.
Director of Extension Work	C. W. Warburton.
Director of Information	Nelson Antrim Crawford.
Director of Personnel and Business Administration.	W. W. Stockberger.
Solicitor	R. W. Williams.
Weather Bureau	Charles F. Marvin, *Chief.*
Bureau of Agricultural Economics	Henry C. Taylor, *Chief.*
Bureau of Animal Industry	John R. Mohler, *Chief.*
Bureau of Plant Industry	William A. Taylor, *Chief.*
Forest Service	W. B. Greeley, *Chief.*
Bureau of Chemistry	C. A. Browne, *Chief.*
Bureau of Soils	Milton Whitney, *Chief.*
Bureau of Entomology	L. O. Howard, *Chief.*
Bureau of Biological Survey	E. W. Nelson, *Chief.*
Bureau of Public Roads	Thomas H. MacDonald, *Chief.*
Bureau of Home Economics	Louise Stanley, *Chief.*
Bureau of Dairying	C. W. Larson, *Chief.*
Fixed Nitrogen Research Laboratory	F. G. Cottrell, *Director.*
Office of Experiment Stations	E. W. Allen, *Chief.*
Office of Cooperative Extension Work	C. B. Smith, *Chief.*
Library	Claribel R. Barnett, *Librarian.*
Federal Horticultural Board	C. L. Marlatt, *Chairman.*
Insecticide and Fungicide Board	J. K. Haywood, *Chairman.*
Packers and Stockyards Administration	John T. Caine, *in Charge.*
Grain Futures Administration	J. W. T. Duvel, *Acting in Charge.*

This bulletin is a contribution from

Bureau of Plant Industry	William A. Taylor, *Chief.*
Office of Western Irrigation Agriculture	C. S. Scofield, *Senior Agriculturist, in Charge.*

32

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY

▽